



Research report

The effects of emotion regulation on the desire to overeat in restrained eaters[☆]Jennifer Svaldi^{a,*}, Brunna Tuschen-Caffier^a, Helmut K. Lackner^b, Sabine Zimmermann^a, Eva Naumann^a^a Department of Clinical Psychology and Psychotherapy, University of Freiburg, Engelbergerstrasse 41, 79106 Freiburg, Germany^b Institute of Physiology, Center of Physiological Medicine, Medical University of Graz, Austria

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ABSTRACT

The aim of the present study was to test whether emotion regulation (ER) strategies are underlying processes in the link between negative emotions and the desire to overeat (DTE) in high restrained eaters (HR). Forty-eight female HR and 46 female low restrained eaters (LR) watched three sadness inducing film clips. Thereby, participants were randomly assigned to and trained in one of three conditions while watching the first two clips: to suppress upcoming emotions, to accept upcoming emotions or to reappraise the situation. After that, they participated in an experiment in which the learned ER strategy was implemented while watching the third sadness inducing film clip. DTE and sadness were assessed prior to and at the end of each clip. Additionally, physiological measures of the sympathetic and parasympathetic branch were obtained. In the HR group emotion acceptance and suppression lead to a significant increase of the DTE from baseline to post-film, while there was no change in DTE in the reappraisal condition. However, psychophysiological measures were not moderated by ER strategies. The results are discussed in terms of the limited resource model.

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Introduction

Dietary restraint is one of the empirically best established risk factors for the development and maintenance of eating disorders (Jacobi, Hayward, de Zwaan, Kraemer, & Agras, 2004), especially for individuals at genetic risk for binge eating (Racine, Burt, Iacono, McGue, & Klump, 2011). It is defined as a cognitive effort to resist the urge to eat with the aim to control one's body weight. However, even though high restrained eaters (HR) constantly try to resist the urge to eat, empirical studies show that they more frequently indulge in binge eating compared to low restrained eaters (LR; Marcus, Wing, & Lamparski, 1985; Wardle, 1980), and eat more when given ad libitum access to food in experimental settings with and without preload conditions (e.g., Herman & Mack, 1975; Jansen, 1996; Mills & Palandra, 2008; Polivy, Coleman, & Herman, 2005).

According to the limited capacity model (Boon, Stroebe, Schut, & Ijntema, 2002; Muraven & Baumeister, 2000; Muraven, Tice, & Baumeister, 1998; Wegner, 1994; Wegner, Erber, & Zanakos, 1993), effortful tasks involve the exertion of self-control. This self-control is supposed to rely on a limited, consumable resource. It is further postulated that, depending on the demands of a certain task, the available self-regulatory resources can be more or less

fatigued. Several experimental studies have yielded empirical evidence of this theoretical model. For example, in one experiment (Baumeister, Bratslavsky, Muraven, & Tice, 1998) participants were exposed to the sight of (tempting) chocolate and (un-tempting) radishes, but allocated to either one of these conditions in a taste test. In addition, there was a no-food control condition. Afterwards, they were asked to solve an (unsolvable) puzzle. Results showed that participants in the radish condition quit sooner on the unsolvable puzzle task than participants in the other two conditions. In another experiment of the same study, participants were exposed to either a humorous or a sadness inducing film clip. In each of these two conditions, half of participants were instructed to suppress upcoming emotions, while participants in the no-regulation condition were instructed to let their emotions flow while watching the clip. Following the clips, participants were asked to solve an anagram. Results indicate that participants in the suppression condition performed significantly worse compared to participants in the no-regulation condition. Similar results have been reported by a study (Wegner et al., 1993) in which regulating one's (previously induced) mood was significantly less successful under cognitive load compared to a condition in which participants did not have the cognitive load. It is also consistent with another experiment (Muraven et al., 1998) showing that compared to a no-regulation condition, decreasing or increasing one's emotional response to an upsetting movie lead to a subsequent drop in physical stamina, as measured by how long participants squeezed a handgrip.

Applying the limited resource model to HR suggests that in the context of restrained eating, overeating occurs only when

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self-regulatory resources are depleted or fatigued by self-regulatory demands. In one experiment (Vohs & Heatherton, 2000) self-regulatory resources were depleted in chronic dieters by asking participants to either inhibit or act naturally to a sadness inducing film clip. In a subsequent task, participants were asked to complete an ice-cream taste test. Results revealed that participants in the suppression condition ate significantly more ice-cream. Replication of these results comes from a more recent study (Hofmann, Rauch, & Gawronski, 2007), whereby participants were instructed to either suppress (depletion condition) or let flow their emotions (control condition) while watching a sadness inducing clip, after which they participated in a taste-test (candy consumption). In addition, the Restraint Subscale (Herman & Polivy, 1980) was administered. Main results revealed that in participants with high restrained standards candy consumption was higher in the suppression condition compared to the control condition.

So far, the mentioned studies support the theoretical concept that HR succeed to maintain their dietary restriction as long as no other situation demands a further act of self-control. Thereby, an amply studied resource depletion variable in restrained eating has been thought suppression (Erskine & Georgiou, 2010) and expressive suppression (Hofmann et al., 2007; Vohs & Heatherton, 2000). While in the depletion model emotion regulation (ER) is generally seen as a consumer of self-regulatory resource compared to a no-regulation strategy (e.g., Muraven et al., 1998), fundamental research on the impact of ER on the experience of emotion (see Gross, 2008 for a review) and ER research in emotional disorders (see Gross, 2008 for a review) stress out the differential impact various ER strategies have with regard to the physiological and self-reported domain of emotion experience and the amount of cognitive resources demanded.

Three frequently examined ER strategies are expressive suppression, cognitive reappraisal and acceptance. Contrary to expressive suppression, acceptance-oriented strategies were shown to be associated with improvements in attentional processing (Lutz et al., 2009; van den Hurk, Gionmi, Gielen, Speckens, & Barendregt, 2010), increased control over limited brain resources (Slagter et al., 2007), greater ability to inhibit incorrect responses in Stroop (like) tasks, thus suggesting a reduction in reactivity due to improved top-down control (Chan & Woollacott, 2007; Moore & Malinowski, 2009; van den Hurk et al., 2010). Similarly, cognitive reappraisal was shown to increase cognitive control (Moser, Most, & Simons, 2010) and emotion experience without reducing memory capacity, while suppression was actually shown to affect memory functioning (Richards & Gross, 1999, 2000, 2006).

The above mentioned studies give evidence of a differential resource depletion in dependence of ER strategies used. In the domain of eating behavior, there is also preliminary evidence that ER strategies applied at the sight of food stimuli can modulate food cravings by changing the mesocorticolimbic activity. For example a recent study (Siep et al., 2011) compared the use of reappraisal, suppression and up-regulation at the sight of food pictures. In the up-regulation condition, participants were asked to actively increase the craving of the presented food picture by thinking about its smell, taste and texture. As expected, food craving was significantly higher in the up-regulation compared to the other two conditions. This increase was accompanied by an increase in activity in mesocorticolimbic regions. However, contrary to what expected, there was no difference in self-reported craving between suppression and reappraisal. There were, however, differences in the fMRI results. Specifically, suppression decreased the activity in mesocorticolimbic regions more successfully than cognitive reappraisal (see also Wang et al. (2009) for similar results in men). The authors interpret their results in terms that suppression better inhibits the behavioral expression of reward processing. However, compared to reappraisal suppression also increased the activity in the bilateral

anterior prefrontal cortex (aPFC) and the dorsolateral PFC, which is in line with the above mentioned studies (Gross, 1998, 2008) that suppression requires increased self-regulatory effort.

At first sight, the two mentioned fMRI studies (Siep et al., 2011; Wang et al., 2009) seem to contradict the results of the Vohs and Heatherton (2000) and Hofmann et al. (2007) study. However, two differences need to be emphasized. First of all, the latter two studies involved HR, a group which is under a constant effort to engage in cognitive control. Second, participants in the fMRI studies were asked to adopt the respective ER strategies for a very short period of time (few seconds). By contrast, HR had to suppress their emotions over the whole length of the clip (about 3 min). Therefore, suppression may better be able to decrease the behavioral expression of reward processing in the short run, however, because effortful, not over a longer period of time. In line with this, suppression may be more effortful for a population which is already under a constant effort to resist the urge to eat.

This aside, in the context of restrained eating, the most frequently studied ER depletion variable is expressive suppression and this strategy has most often been compared to a no-regulation condition, i.e. a situation, in which no demand is put on participants. It is therefore unclear whether it is simply the demand of an additional task or also the nature of emotion suppression which leads to overeating in HR. Therefore, the aim of the present study was to compare the effects of acceptance, reappraisal and suppression in the regulation of induced negative mood with regard to the experience of food craving in a group of HR. To this purpose, participants were randomly allocated to one ER condition and – after a training in the respective strategy – asked to exert the trained strategy while watching a sadness inducing film clip. Thereby, the main variable of interest was the self-reported desire to overeat (DTE), which was assessed prior to and after the clip. Specifically, it was hypothesized that in HR, compared to IR, suppression, but not acceptance and reappraisal would lead to an increase of the DTE.

Furthermore, empirical studies on the exertion of ER strategies also suggest that – beyond self-report – some strategies may be more resource consuming than others also at a psychophysiological level. Specifically, emotion suppression was shown to go along with increased physiological costs (e.g., higher skin conductance) when compared to acceptance (Campbell-Sills, Barlow, Brown, & Hofmann, 2006; Dunn, Billotti, Murphy, & Dalgleish, 2009; Hofmann, Heering, Sawyer, & Asnaani, 2009) or reappraisal (Gross, 1998, 2008). Our aim with the inclusion of psychophysiological variables was therefore threefold: First, previous studies have shown that although sometimes at the self-report level no differences in dependence of ER used emerge (Gross & Levenson, 1993; Siep et al., 2011), differences are still given at a physiological or brain activity level. Hence, measures other than self-report can give some important insight into mechanisms of maintenance. Second, in contrast to suppression and reappraisal, the literature on the physiological correlates of acceptance is considerably smaller. In line with this we were interested in the physiological costs of acceptance compared to suppression and reappraisal. Third, we wanted to gain more insight into the physiological correlates of an increased DTE.

So far, empirical evidence suggests that suppression increases physiological costs. However, depending on the emotion triggered, such increased physiological costs may lead to either a stronger increase or decrease in sympathetic activity. For example, while fear-eliciting films were shown to increase heart rate, sadness-inducing film clips were shown to decrease HR (Kreibig, Wilhelm, Roth, & Gross, 2007). Therefore, we hypothesized that suppression, but not reappraisal and acceptance would show a stronger physiological reaction. However, because we induced sadness, we hypothesized that suppression, compared to acceptance and reappraisal, would

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